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were probably leptiform, and the eruciform condition is consequently an acquired one, as suggested by Fritz Müller.* His suggestion, followed up by Brauer, that the insects have descended from some zoea does not seem of much value, as the leptiform larva more exactly parallels the nauplius of the lowest Entomostraca (Copepoda). We have already suggested that the Insects and Crustacea probably arose by two distinct lines of development from the worms, rather than that the Nauplius gave rise to the Insects, as Müller has suggested; an important reason for this view being that the three pairs of appendages of the Nauplius do not homologize with the distinct cephalic and three thoracic appendages of the Leptus.

THE ORGANIC IDENTITY OF THE ALBUMEN AND ENDOPLEURA OF ALL THE PHANEROGAMÆ.—BY T. C. HILGARD, M. D.

ALL seeds of the flowering plants (the net-leaved, blade-leaved and the pine tribes) are collectively described as consisting of a *germ* or "embryo," enclosed within *two separate seed-coats.*

A great many seeds, like those of the mustard, nasturtium, buck-eye, bladder-nut, the ailanthus, sumach, china-tree, orange, camellia; the gum-pod ("gumbo"), hibiscus, the cocoa-bean, almond, pea and rose-tribes, the brazil-nut, walnut, chestnut; the cockle-bur, sun-flower and melon all conform to this description, and the natural tribes to which they belong form a connected region of the flowering plants generally speaking.

It is likewise understood that a great many seeds have their germ proper imbedded in a bulky, nutritive lump called the "*albumen*"; which thus forms the main bulk of the seed, *e. g.* of the ivory-nut, the date-kernel, the cocoa-nut, the pepper, paw-paw and nutmeg, and all the grains no less than the well known coffee-bean. In water, the latter will swell and protrude its stubble-like embryo out of one end of its horny, enveloping mass, or "*albumen.*"

It has, however, hitherto remained an unnoticed fact that all seeds which have *two* so-called seed-coats, are all alike *destitute of*

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* "It is my opinion that the 'incomplete metamorphosis' of the Orthoptera is the primitive one, *inherited* from the original parents of all insects, and the 'complete metamorphosis' of the Coleoptera, Diptera, etc., a subsequently acquired one."—*Für Darwin.* Eng. Trans. p. 121.

an " albumen ;" and that all seeds *provided* with an albumen, have only one *solitary seed-coat*, *aside from the albumen itself.* *

In many other seeds, as in those of the Osage orange (Maclura) and several Cactaceæ, etc., the albumen is thinned out, in some places, into a so-called " endopleura " or interior seed-coat, while in other parts of the seed the sheet of this self-same " internal seed-coat " thickens up into a bulky albumen, conformably to the configuration of the germ it encloses and of the *testa* which contains both.

An inspection of the *immature seed* of all the so-called *ex*-albuminous forms, *i. e.* those which, like the pea-nut, peach, and almond, are destitute of an albumen, discloses the fact, that in this juvenile condition, all these seeds, have, like all the rest (viz. the " albuminous seeds") a large *succulent albumen-zone*, wherein the germ ("embryo sac" etc.) is developed, at the expense of the former. During the process of ripening, in all the *nutty*, or " *ex*-albuminous " seeds, the primitive albumen becomes gradually *exhausted*, leaving its entire cell-tissue compressed and empty behind, as the delicate endopleura or internal seed-coat. In all the other seeds, on the contrary, this succulent albumen-zone remains the storehouse for the germinating seed to draw its substance from. In the honey-locust and the allied coffee-nut tree (Gymnocladus) in germination, the flinty albumen dissolves into a sort of gum, like gum arabic.

In point of fact, the " endopleura " and the " albumen " are one *identical organ.*

This evident identity of the original albumen and subsequent second seed-coat, settles at once the old and perplexed question about the erroneously supposed "*gymnospermism*," whether of Labiatæ, Coniferæ and their allies, the Taxineæ, Gnetaceæ, Casuarinæ and Cycadeæ.

Since we now know, what *parts* all seeds *consist of*, these tribes are by no means to be considered as " abnormally " or even " monstrously " organized (as a prevalent theory still holds) but that *e. g.* all the *edible pine-nuts* contain, each, a *complete seed* ; which loosely adheres to the capsule (like the mature cocoa-nut kernel) and is encased within a one-seeded pistil, as is the case *e. g.* with all grasses, grains and the knot-weeds; their true ovules being mostly sessile (as in the entire orders of Polygonaceæ and Nyctaginaceæ, with only few exceptions) and considerably coherent with the true pistil (or stigmatiferous "utricle"). In the above-mentioned coniferous tribes, these one-seeded pistils are provided with a pervious, "open" stigma; a case correspondingly represented in the duck-weeds (Lemnaceæ) which however have their seeds borne upon a *funiculus*.

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* The testa, or exterior seed-coat, frequently exhibits a diversified structure of external and internal surfaces. In the seed of the magnolia, that of the grape, etc, the exterior surface of the otherwise bony seed-coat, which encloses the albumen, is fleshy; as is the entire testa of the blue cobosh (Caulophyllum.)

The seed itself, of Coniferæ, is a complete one, consisting (1) of a germ; (2) an (oily) albumen and (3) one thin, brown, membranaceous seed-coat (the *testa*), readily separating from the utricle or nut-shell which surrounds it, as in the well-known cases of the pine-nuts of California, Italy and that of Switzerland (*Pinus lembra*).

Thus, it is clear that the pine-*scales* are only a woody cup or *cob*, of indurated "saucers" or involucres (as with acorns) that arise in the axils of delicate and sometimes colored bracts. Similar involucral cups we find in the harsh cones of the alder, and in the sterile aments of the wild hemp tribe.

The wing-like appendages of the pine-nuts represent so many *paleæ* or *floral chaff* (like that of grains and bulrushes, etc).

In the remarkable case of Welwitschia, the "kettle-drum pine" of western tropical Africa, no such indurated scales, but only the purpureous bracts, as are those of flowering larch-trees, are developed. The true *perianth*—judging by Dr. J. D. Hooker's plate viii—being here a delicate, foliaceous two-winged one, epigynously concrete with the nut, as is the chaff of pines and two-seeded capsules of Araucariæ. Nevertheless, the same identical organ is erroneously styled "a pericarp" on the preceding plates, by a *lapsus calami* of the same author, on the uncritical bias of *so-called* "gymnospermism." * The so-called gymnosperms have *closed pistils!*

It is thus clear, that there is *no* "*break*" in the vegetable kingdom: all forms uniting into a complete, connected and harmonious

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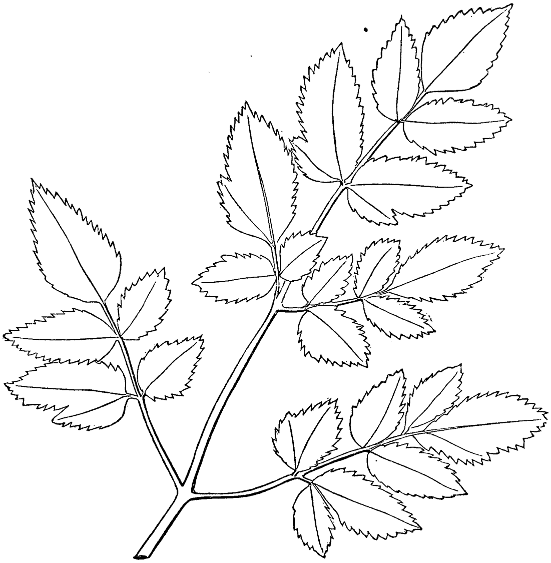
* The untenable theory, here referred to, considers the pine-*scale* as a "pistil;" destitute, however, of any of the *distinctive attributes* of a pistil, being without a suture, without a stigma, and without any fructification through its instrumentality.

The true (one-seeded, *pluri-ovulate*) pistil, or "utricle," was wrongly regarded as an (abnormally "*naked*") "ovule"; with an *abnormally rostrate* "exostome," viz: the (open) stigma! Next follows (after this *pseudo* "testa") the true seed-coat under the system of mutual typical affinities or correlations, to be discussed in detail in a subsequent paper.

INEQUILATERAL LEAVES.—BY PROFESSOR W. J. BEAL.

THE leaves of most plants, such as those of the white oak, sugar maple, and tulip tree are equilateral, *i. e.*, the right and left sides are of the same size and match each other, as the two sides of the nose and chin, or the right hand and foot match the left. Some simple leaves and many leaflets of compound leaves show a marked

Fig. 100.



Compound leaf. After Spencer.

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denomination of an "endopleura",—and an "*albumen*" *besides*, which contains the embryo.

The true solitary seed-coat adhering to the pistil, the shrunken albumen will often be found lying loose inside.

The contended fruit of the well-known yew-tree contains (1) an embryo, imbedded within (2) an albumen, which is surrounded (3) by a tawny seed-coat. The latter loosely adheres to a thickish *capsule*, which is itself *covered by a thick, calycine layer*! —in the exact likeness of an acorn, a hazelnut, or the nut of the sweet gale (Myrica; the wax-myrtle or bayberry) which indeed seems to reproduce the true (*epigynous*) structure of the former on a reduced scale; as the (Composite) *Polymnia Uvedalia* or "nutted leaf-cup."

The cup of the yew-tree thus remains to be properly interpreted as a fleshy cup partly of dry scales, like those of the acorn and wax-myrtle on the one, and the succulent Euphorbia-involucres on the other hand.